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ON SOME ETHEOSTOMINE PERCH FROM TENNESSEE AND NORTH CAROLINA.

By E. D. COPE.

ETHEOSTOMA, Raf.

The species of this genus are nearly allied to each other. I gave a synopsis of the three with which I was acquainted in 1866 (Trans. Amer. Philos. Soc., p. 400), and now add characters of two other species. They are to be compared with the *E. peltatum*, Stauffer, and *E. maculatum*, Girard.

A Scales 7-8-52-5-8-12.

I. Head 4.5 to base of tail; cheeks scaled.

R. D. XIII.12 A II.8 Muzzle obtuse, wide; maxillary to line of pupil; maxillary teeth nearly equal: a series of separate spots on the sides behind scapula.

E. NEVISENSE.

II. Head 3.6 to 4 times to origin caudal; cheeks naked.

R. D. XI-XII.12-13 A II.9 Muzzle compressed acute; maxillary to line of pupil; a larger series of maxillary teeth exteriorly; a series of eight spots on the sides connected by a band; eye near four times in head.

E.? MACULATUM, var.

“R. D. XIV.14 A II.10 Maxillary to line of orbit.” Girard.

E. MACULATUM.

R. D. XIII.13 A.I.10 Maxillary to line of pupil.

E. PELTATUM.

ETHEOSTOMA NEVISENSE, Cope.

Sp. nov.

This is an elongate fish, with muzzle obtuse in profile, as well as wide, viewed from above; cheek, operculum and median dorsal line scaled; ventral line without spinous scales, one only present in the symphysis of the “coracoids.” Isthmus very narrow. Anal fin with base a little shorter than second dorsal; the species may really be a *Poeciliichthys*. Scales 8-53-11. First dorsal moderately elevated; second peculiar in spinous ray, well separated from the first dorsal. Caudal fin slightly forked.

Ground color above yellowish, crossed by nine dark chestnut quadrate spots on the median line, which are wider than their interspaces, and are connected at their ends by an undulate chestnut band. Below the latter a similar longitudinal band on the anterior half of the body. Six quadrate black spots on the sides, with a small spot between each. A dark band from end of muzzle to scapula; below it on operculum, a silver spot. A black bar below eye. Belly white. Caudal and second dorsal distinctly, pectoral and ventral, faintly black barred. A series of black spots along middle of first dorsal.

Length 3 in. 25 lin. Diameter orbit 2.2 lines. Depth at first ray second dorsal 4.8 lines; at occipital region 4 lines.

This species, though near the next in general appearance, is very different in details of structure, and I am not sure that it may not be referable to the genus *Poeciliichthys*. It is based on one specimen which was taken

in boisterous water at the falls of the Neuse River, 8 miles east of Raleigh, North Carolina.

ETHEOSTOMA MACULATUM, Girard.

Putnam Bull. Mus. Compar. Zool. No. I *Hadropterus maculatus*, Girard, Proc Acad. Nat. Sci., Phil. 1859, 100.

My specimens differ from that described by Girard as expressed in the table above, and they may be distinct. They differ among themselves thus: In two specimens the radii are DXI.13; in two XII.13, and in one XII.12. The type of *E. peltatum*, Stauff., differs also; its anal radii should be expressed I.10, not II.9 as heretofore given. I am, therefore, not sure whether it belongs to this genus.

Several specimens from the upper waters of the Catawba River.

ETHEOSTOMA BLENNOIDES, Raf.

From the headwaters of the Cumberland River, Campbell co., Tenn.

COTTOGASTER, Putn.

COTTOGASTER AURANTIACUS, Cope.

Jour. Acad. Nat. Sciences, Philada. 1868, 211.

One specimen from the French Broad River in Madison co., N. Ca., measuring 4 inches, 8 lines in length, more than twice the size of the types, and larger than any species of the group excepting *Percina caprodes*. Colors, bright yellow and black in life.

PERCINA, Hald.

In this genus the median line of the abdomen and thorax is protected by a series of enlarged spinous scales, as in *Etheostoma*. This is no doubt a protection to the belly from the rocky and stony bottoms which the animal haunts.

PERCINA CAPRODES, Raf.

From the South fork of the Cumberland River, Campbell co., Tenn.

POECILICHTHYS, Agassiz.

I. Branchiostegal membranes distinct throughout their length.

Slender; head attenuated, muzzle not decurved; depth 5.25 lines in length to base caudal; first dorsal low, elongate RXII (XIII); scales small l. l. 55-62. Black with scattered crimson spots; fins crimson not margined;

P. SANGUIFLUUS.

Stout, head short, muzzle abruptly decurved from orbits, latter large, scarcely four times in head; dorsal line plane, depth 4.5 times in length; first dorsal elevated R. X (XI-XII); scales larger l. l. 50-54. Black with crimson spots in rows of three and four; fins crimson, yellow and black margined.

P. CAMURUS.

Stout, head acuminate, muzzle not much decurved, dorsal line much arched, depth 4.5 in length; first dorsal elevated (X-XI) XII; scales largest l. l. 43-47; eye small, nearly five lines in length of head. Light, with narrow dark lines enclosing spaced quadrate red-brown spots; below orange; head brown lined, fins crimson bordered.

P. RUFINLINEATUS.

Like the last but D.XV, scales smaller l. l. 53, and dorsal line not

arched. Light, with dark olive vertical cross-bars, and a few scattered crimson spots; red spots on middle first dorsal, other fins unspotted.

P. VULNERATUS.

II. Branchiostegal membranes united across thoracic region.

Slender, cylindric; muzzle acuminate depressed; orbit 4.5 times in head; depth 6.5 in length, D.VII small; P. very long, reaching the anal; naked below anteriorly; cheeks and operculum scaled; transparent in life, with dorsal and lateral spots.

P. VITREUS.

POECILICHTHYS ZONALIS, Cope.

Journ. Acad. Nat. Sci., 1868, p. 212, tab. 24, f. 1.

The vertical bands which are represented as brown in the above figure, are a beautiful turquoise blue in life.

From a tributary of the French Broad River, Madison co., N. Ca.

POECILICHTHYS FLABELLATUS, Raf.

Putnam Bull. Mus. Comp. Zool. 1. (*Catonotus*) Cope, l. c. 213.

A very marked variety, perhaps species, represented by three specimens from the upper waters of the Catawba River, N. Ca. Scales much larger than in the types, 6—42—4—9—10; in the only adult there are but four vertical cross-bars below the dorsal fins, (six to eight in the usual variety) and the fin formula is much reduced, i. e. DVI—12 A II.6. In a younger specimen the D.VII—12 A II.8, and in a third, D.VIII—12 A II.7.6. The dorsal and lateral spots are more numerous than in the adult. Head in the latter 3.5 times in length to caudal. In other respects this form is like the type, except that in life the colors are paler.

POECILICHTHYS VITREUS, Cope.

Spec. nov.

This species is very unlike the others of the genus, having the cylindric form of *Percina* and *Pleurolepis*; it further resembles *Pleurolepis pellucidus* in the transparency of its muscles, but is to be referred to another genus on account of the reduction of its anal fin, and its complete scutellation.

The head is remarkably acuminate, the profile gradually descending and the under jaw received within the upper; the mouth is nearly terminal, and the extremity of the maxillary bone reaches barely to the line of the anterior margin of the orbit. Both cheeks and operculum are covered with large pectinated scales, the former as far as the preopercular bone. Opercular spine rudimental, flat, as in some individuals of *P. flabellatus*. The orbit is relatively small, its diameter being less than the length of the muzzle in advance of it, and a half less than one-fourth the length of the head. Depth of head at deepest point, one-half its length; its length 4.5 times in length of body to basis of caudal. The fins are not largely developed, except the pectoral, which is very long and acuminate, reaching the line of the vent. Br. VI. D. VII—14. A II.9. Ventrals cuneiform, a little over half the length of the pectorals. Caudal nearly equal or slightly concave. Scales 6—56—7, counted from the anterior ray of the second dorsal to the vent. On the anterior half of the dor-

sal region they are not continuously developed and are cycloid; a large part of the most anterior portion is naked. On the anterior fourth the ventral surface the scales are cycloid, not imbricate, and below the pectoral fins entirely absent. Other scales ctenoid. Caudal peduncle not deep nor constricted.

	Lines.
Total length.....	24
Of caudal fin.....	3.6
Of basis first dorsal.....	3.4
Of pectoral.....	8.4
Of muzzle.....	1.5
Width of body opposite first dorsal.....	2.3

In life this species is nearly colorless, and the myocommata and other muscles are transparent. The viscera are perfectly visible, and in the specimen taken, the two ovaries with all the eggs in an advanced stage of development were seen with entire distinctness. There are seven imperfectly formed pale green blotches on the dorsal line, and a series of eight or nine on the lateral line of a linear form, arranged longitudinally, and of the same greenish tint. A few blackish specks between these, and below the eye; a large spot on operculum and line on canthus rostralis. Caudal fin faintly barred; other fins and lower surfaces immaculate; ventrals with white edge within.

One specimen taken in Walnut Creek, a tributary of the Neuse River, in Wake co., N. Carolina, late in November.

From the advanced condition of the eggs they must be excluded either in the Winter, or a very early Spring, for even that mild latitude. In its transparency this fish resembles the *Pleurolepis pellucidus*, Agass. When first taken its scales are entirely invisible, and it requires coagulation in alcohol before they can be readily detected.

The vomerine teeth of this fish are very few in number, and the maxillaries and mandibulars are very abruptly incurved.

POECILICHTHYS SANGUIFLUUS, Cope.

Species nova.

Of the same form as the *P. flabellatus*; i. e. elongate, with dorsal line not elevated, and very deep caudal peduncle. Head flat acuminate, the front descending very gradually, the mandible as gradually rising to its extremity. Orbit rather large, diameter equal to that of muzzle, and one-fourth length of head. Opercular spine well developed, the operculum scaled, cheek naked. End of maxillary marking line of pupil. Teeth of outer rows larger. Length head without spine, one-fourth total to basis caudal. Fins generally, especially the caudal, short; latter slightly rounded. First dorsal much elongate; first anal spine very large. In four specimens the fin and scale formulae vary as follows: 1st, Br VI. D.XII-12. A II-8; 2nd, D.XII-12. A II-9; 3rd, XII-13. A II.9; 4th, DXIII.12 A II.9. Scales 9—54-62—10.

	Lines.
Total length.....	31
Of head.....	7
Of caudal fin.....	4
Pectoral.....	5.6
Basis first dorsal.....	8.4
Depth at occiput.....	4

The coloration of this fish in life is very elegant, as follows: above black, shading to dark olive below, and with a narrow, repand, leather colored dorsal band; throat turquoise blue; sides and dorsal region marked with small circular spots of bright crimson irregularly disposed, and in considerable number. First dorsal uncolored, with a black spot at base anteriorly, and a dark shade through the middle. Second dorsal blood red, without border; caudal with two large crimson spots confluent on the middle line of the tail at the base, no border; pectoral and ventral not red bordered. A female has the 2D. C. and A. black barred, and not crimson.

This lovely species is common in the head waters of the South Fork Cumberland, in Tennessee.

POECILICHTHYS CAMURUS, Cope.

Species nova.

This species is nearly allied to the last. It is distinguished by many characters, of which some have been pointed out in the synoptic table. It is a stout, deep-bodied fish, not a slender one, and with the head as deep as the body and suddenly decurved from the orbit to the muzzle. The first dorsal is higher and shorter, though occasionally with the same number of radii. The scales are larger. In life the coloration though of the same type, is constantly different, and the females differ from the males as they do in the preceding and following species.

Maxillary bone opposite line of pupil; cheek extended, naked; operculum scaled, with a strong spine. Fins better developed than in *P. sanguifluus*. Formulae in five specimens; first, Br. VI D. X-13 A. II.8; 2nd, D X-13 A II.9; 3rd, D. XI-13, A. II. 8; 4th, XI-14 A II. 8; 5th, DXII-12. A II.8. Scales 7—52—4—8.

	Lines.
Total length.....	31
Of head.....	7
Of caudal fin.....	4
Of pectoral.....	6.2
Basis of first dorsal.....	7.2
Depth of occiput.....	5
At middle first dorsal.....	5.2

In life the color is blackish to very dark olive, with an obscure dorsal band of a paler shade; belly paler. Sides abundantly sprinkled with crimson spots, which are smaller than in the *P. sanguifluus*, and differ further in being arranged in short longitudinal series of threes and fours. First dorsal with a black spot at base in front, and a crimson one on the margin between the first and second radii. Second dorsal, caudal and anal, crim-

son bordered with yellow, which again is bordered with black on the edge of the fin; the crimson is deepest just inside the yellow margin in all three. The pectoral and ventral fins have a broad red margin. Thoracic region turquoise.

This species, like the last, occurs abundantly in the head waters of the Cumberland River, in Tennessee, in company with *P. coeruleus*, *Hyostoma*, and *Etheostoma blennioides*.

The females of the first two present a different appearance, in their olive colors, with dark vertical bars, and absence of red spots. All of the above species lie on the bottom, frequently beneath stones, with the head only projecting on the lookout for prey. Ordinarily they lie motionless, except occasionally inclining their position and exhibiting their gorgeous colors. The effect of these is heightened by the crystal clearness of the waters of the mountain streams, which reflect as well the beauty of a southern sky, and the noble trees and flowering shrubs that border them in the rich wilderness of the Cumberland range. Few more attractive spots to the naturalist can be found, and among its natural treasures, these peculiar little fishes are among the most curious. All the fishes of this group can turn the head from side to side, and they frequently lie in a curved position, or partially on one side of the body.

It is possible that one of the two species above described may be the *P. maculatus* (*Etheostoma*, Kirtl. *Nothonotus*, Agass), but which, I have in vain essayed to discover. It may be neither. The description of form and colors apply best to the *P. sanguifluus*, but its dorsal fins are those of *P. camurus*. If the statements "operculum double spined" and "anal I-7" are correct, it is manifestly different, but I suspect they are errors.

The caudal peduncle is represented to be much more slender than in our specimens, but this may also be inexact.

POECILICHTHYS VULNERATUS, Cope.

Species nova.

General form fusiform; body stout, depth 4.5 times in length to basis caudal, peduncle very stout; dorsal line scarcely arched. Top of head gently and regularly curved to end of muzzle, much as in *P. sanguifluus*. Orbit four times in length of head to basis of opercular spine, equal length of muzzle, cheek smooth, operculum scaled, with well developed spine. Fin rays DXIV. 13. A II 8. First dorsal large, not low, caudal truncate rounded, anal small. Scales small 8—53—9.

	Lines.
Total length.....	25
Caudal fin.....	3.8
Base first dorsal.....	7
Of head.....	5.6
Depth at occiput.....	3.4
At posterior margin first dorsal.....	4.6

Color in life, light olive, with about eight vertical dark olive bars on the side, which are interrupted above the lateral line. A few irregular crimson dots on the sides. Fins uniform transparent except the first dorsal

and caudal; the former has a median series of red spots; the latter is pale orange, with a black margin; no fins cross-barred; D. 2, with a black margin.

From Warm Springs Creek, a tributary of the French Broad River, Madison co., N. Carolina.

This species is in general proportions intermediate between the *P. rufilelineatus* and *P. sanguifluus*, but is in some points of coloration like the *P. camurus*. That it is not the female of *P. rufilelineatus* is clear, though its size is similar to the smaller individuals of the latter. The coloration alone would indicate that it was a male.

POECILICHTHYS RUFILELINEATUS, Cope.

Species nova.

Stout, the dorsal line elevated and descending regularly from the base of the first dorsal ray to the end of the muzzle. Muzzle short, regularly conic, about as long as the diameter of the orbit; latter smaller than in the other species, 4.5 times in head. Maxillary to line of pupil. Cheeks smooth, operculum scaly, with strong spine. Dorsal well developed; caudal peduncle deep, caudal fin small truncate. Scales larger than in the species above described; 6—41—7—7—8. Rays; 1st D. X. 12. A II.8. 2nd, D. XI. 12 A. II.8; 3rd, XI. 12, II.9; 4th, XI. 13, II.8; 5th and 8th, XII. 12 II.8; 6th, XII. 13, II.8; 7th, XII. 11, II.8.

	Lines.
Length of the largest.....	32.5
Of a second.....	31
Of head of latter.....	6.4
Of caudal fin.....	4.4
Of pectoral fin.....	6.4
Basis of first dorsal.....	9.3
Depth at occiput.....	2.3
At middle first dorsal.....	5.8

In males the color in life is pale olive for a ground above, with numerous narrow longitudinal lines, each on the adjacent margins of the two rows of scales. These include a number of quadrate spots of a mahogany or brick red color, which alternate with each other, but are not regular in position or number. Pectoral region turquoise blue, belly bright red orange. Head with two longitudinal mahogany-colored bands, and a spot of the same below the eye. Five red spots on each side of the head, on operculum, preoperculum, suboperculum, and on each lip. Pectoral, ventral, first and second dorsal and anal broadly crimson bordered, the last with a narrow black margin. Caudal fin brownish, broadly vermilion bordered, with a narrow black edging; two orange areas at the base. Anal vermilion with yellow base and black margin on posterior half.

Females are more olive, and the spots are partially confluent into vertical bars;—D. 2, C., and A. black barred. A male forms a variety with the quadrate spots obsolete and the D. 2, C., and A. with yellow margin inside the black.

This fish was abundantly seen in Warm Springs Creek, which flows into

the French Broad River, in Madison co., N. Ca. Eight specimens were taken with some difficulty. The beauty of the species is scarcely exceeded by any of the preceding; if not so elegant, a male in summer attire is more gaudy. They inhabit shallow, swift waters with rocky bottoms, and take refuge under stones with great rapidity, whence much patience is required to draw them.

The conic form of the head, small orbit and elevated dorsal region, characterize this species among other points apart from coloration.

POECILICHTHYS COERULEUS, Storer.

From the South Fork of the Cumberland, Tenn.

BOLEOSOMA, Dekay.

Second dorsal larger than anal fin; vomerine teeth present; no series of abdominal plates; two osseous anal radii; scales well developed; premaxillary projectile, the labral dermal fold extended across the muzzle.

This genus is identical with *Poecilichthys*, excepting in the completion of the labral fold, which in the latter genus ceases on each side of the muzzle. The simple anal, formerly assigned as its character, I find to belong to one or two species which are so nearly allied to the type as to preclude their generic separation.

Synopsis of Species:

I. Anal radii, II.

Caudal peduncle thick, not contracted; cheek scaleless; branchiostegal membranes nearly distinct, spine rudimental; tail rounded; muzzle blackish.

B. EFFULGENS.

Caudal peduncle contracted, dorsal line not elevated; cheek scaleless; branchiostegal membranes well connected, spine developed; tail truncate; crown and muzzle closely brown spotted above.

B. MACULATICEPS.

II. Anal radii, I.

Caudal peduncle contracted, dorsal line not elevated; cheek scaled; branchiostegal rays well connected, spine strong; tail truncate; crown and muzzle unicolor.

B. OLMSTEDI.

Caudal peduncle contracted, dorsal line not elevated; cheek smooth; D. 2 with 11-12 radii only; branchiostegal membranes connected, tail truncate; back and top of head closely speckled with black.

B. BREVIPINNE.

III. Anal osseous ray wanting.

Caudal peduncle contracted, dorsal line arched from the nape; cheek ? naked; branchiostegal rays entirely distinct, spine well developed; tail truncate.

B. AESOPUS.

The preceding definitions apply to considerable numbers of individuals from remote localities; these may be species, for the range of variation is very considerable, and such as is to be found nowhere else in a single species. Should they be found to present intermediate forms in regions not yet explored, they may be regarded as races, and as such, worthy of note.

BOLEOSOMA EFFULGENS, Girard.

Arlina effulgens, Girard, Proc. Ac. Nat. Sci., Phil., 1859, 64.

Char. Muzzle abruptly decurved, body elongate, slender; scales large. Fins very much developed, elevated and prolonged D. IX. 13. A II. 8. Cheek and pectoral region smooth, operculum scaled, branchiostegal membranes slightly connected. Muzzle and fins black.

Description. The mouth is horizontal, the premaxillary border below the lower margin of the orbit; maxillary to pupil. Dorsal line a little elevated above the occiput, greatest depth 6.25 times in length to origin caudal; length of head 4.2 in some (spine omitted). Opercular spine weak; orbit 3.75 times in head, equal muzzle. Scales 5—40—6. Fins all elongate; V 1.6, cuneiform, reaching the anal; P. 11, narrow, reaching beyond the base of the anal. Anal spines weak, caudal very much rounded.

	Lines.
Total length.....	28.3
Of caudal fin.....	5
Of head.....	6
Of basis first dorsal.....	5.3
Of pectoral.....	6
Depth of first dorsal.....	6
Of second.....	3.7
Of head at occiput.....	3.2
Of body at middle first dorsal.....	4

The color of three specimens in alcohol is brown with traces of nine spots on the side. Muzzle, chin and spot below the eye black. Fins black, the second dorsal and caudal with whitish bars and specks.

Three specimens were taken in a tributary of Deep River, Guilford co., N. Ca., by my friend, Samuel C. Collins, Principal of the boarding school at New Garden, N. Ca., and kindly sent me for determination.

BOLEOSOMA MACULATICEPS, Cope.

Sp. nov.

R. D IX. 13 A II. 8. Head four times to basis of caudal fin; depth at middle of first dorsal 6.5 times in same. Scales 5—41—10. Fins largely developed. Orbit 3.75 times in head; opercular spine moderate.

Pale yellowish, with ill-defined series of dorsal and lateral spots and many speckles between. Top of the nape, head and muzzle marked with large brown spots. All the fins black barred.

	Lines.
Length.....	26.8
Pectoral fin.....	6
Median depth.....	3

This species is near the *B. olmstedii*, and may be only a variety. Its clean cheek and double anal spines are characteristic, as well the markings of the head. Common in the upper waters of the Catawba River, N. Carolina.

BOLEOSOMA OLMSTEDI, Storer,

et acctorum.

Not seen by me in Tennessee or North Carolina. The adult males of

this species, as I have observed in Pennsylvania, are much larger, and more darkly colored, especially about the head, than the females.

BOLEOSOMA BREVIPINNE, Cope.

B. olmstedii brevipinne, Cope, Journ. Ac. Nat. Sci., 1868, 214.

The thick punctation of the dorsal region and nape, and crown and muzzle, are color peculiarities of this form. The cheek is smooth. In *B. olmstedii* it is scaled, though in badly preserved specimens they are occasionally rubbed off.

Many specimens from tributaries of the Ohio, i. e. the Kiskiminitas and Miami.

BOLEOSOMA AESOPUS, Cope.

Spec. nov.

The dorsal line descends regularly from the base of the first dorsal fin to between the orbits, and then curves more abruptly to the mouth. Mouth terminal; eye four times in head, once in advance of its front rim. The dorsal line descends from the first dorsal fin, to a somewhat contracted caudal peduncle. Dorsal fins much elevated, VII-14. Pectorals a little elongate, not reaching vent, but little exceeding the very moderate ventrals. A. 0.-10. Scales 5-47-8. Color light brown with six small dark dorsal spots, and ten similar small spots on the lateral line. A black bar round muzzle, and one below eye.

	Lines.
Total length.....	26.6
Of tail.....	4.3
Of pectoral fin.....	5.2
Depth at first dorsal.....	4.6
At nape.....	3.4
Of caudal peduncle.....	2.3

The form of this fish is rather that of a *Poeciliichthys*, while the absence of spinous anal ray is peculiar to the present species. From the number of rays, 10, in the anal, it is probable that the missing spinous ray is represented by the first cartilaginous ray, and is not wanting. In general it is so near to the *B. olmstedii*, as not to be removed from the genus.

Found in the Loyalsoc Creek, in the Allegheny region, in Lycoming co., Penna., by Aubrey H. Smith, of Philada.

HYOSTOMA, Agass.

Cope, Jour. Ac. Nat. Sci., Phil., 1868, 214.

HYOSTOMA CYMATOGRAMMUM, Abbott.

From the head of the Cumberland, Tenn., and French Broad River, N. Ca. I consider *H. blennioperca*, Cope, l. c., as only a variation of this species.

HYOSTOMA SIMOTERUM, Cope.

Jour. Ac. Nat. Sci., Phil., 1868, 215.

From a tributary of the Clinch River, Tenn.